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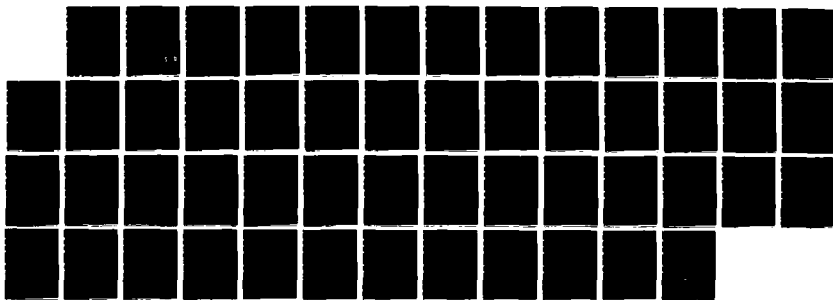
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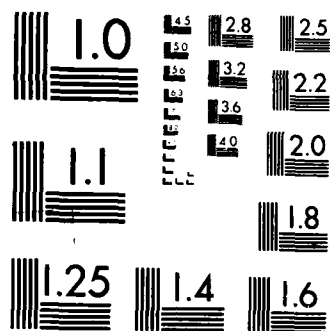
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AirLand Battle
and
Tactical Command and Control Automation

by

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ABSTRACT

AIRLAND BATTLE AND TACTICAL COMMAND AND CONTROL AUTOMATION by Major Robert J. Reese, USA, 45 pages.

This study analyzes tactical command and control automation systems and AirLand Battle doctrine to determine if the degree of control implemented by the automation is congruent with the command and control requirements of the doctrine.

Tactical command and control automation systems and associated doctrine from three different periods are considered: 1954 to 1973, 1974 to 1980, and 1981 to the present. In the first two cases, doctrine and associated automation systems are examined along with some of the major factors that influenced their development. The degree of centralized control is identified. AirLand Battle and the Army Tactical Command and Control System (ATCCS) are the primary subjects of the last period. The precepts of AirLand Battle doctrine are examined to identify generic requirements for decentralized tactical command and control. These requirements are compared with emerging tactical command and control automation systems to determine if the two are consistent.



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INTRODUCTION

The U.S. Army is developing and fielding an automation system that is designed to provide an unprecedented level of support to tactical commanders and their staffs. Known as the Army Tactical Command and Control System (ATCCS), it integrates component automation systems and supporting communications into a program of unparalleled scope.¹ While automation support will be provided to all battlefield functional areas,² at least as low as section or team level in many cases, the major objective of the ATCCS is to assist commanders and their staffs in planning, directing, and executing operations at corps through brigade level.³

The ATCCS will implement a great degree of standardization in command and control procedures. This is true for vertical systems that support command and control within various battlefield functional areas as well as those that integrate vertical (or functional) systems at a given echelon of command level, division for example. Procedural standardization results from factors

¹Enclosure 1, "Letter of Instruction (LOI) of the ACCS Test Bed (ATB) Program," to letter ATZL-CAC-A, Department of the Army, U.S. Army Combined Arms Center and Fort Leavenworth, 30 September 1986, subject: Draft Letters of Instruction (LOI) for the ACCS Test Bed (ATB) and Total System Tactical Validation (TSTV) Program, p. 1.

²Five battlefield functional areas including maneuver, fire support, intelligence and electronic warfare, air defense artillery, and combat service support are used to categorize tactical automation systems. The Army Battlefield Interface Concept first proposed this division of battlefield functions in 1978 (the original names were slightly different); Department of the Army, Army Battlefield Interface Concept 78 (ABIC 78), (Washington, DC, 28 December 1978).

³The Army Tactical Command and Control Systems (ATCCS) Required Operational Capability (ROC), draft, (U.S. Army Combined Arms Combat Development Activity, Fort Leavenworth, KS, 22 September 1986), p. 2.

relating to information management. Information will be passed between echelons and between functional areas by standard messages, processed by standard algorithms, and presented to decisionmakers in standard displays. The format (and in some cases the frequency, content, and recipients) of the messages, the processes executed by the algorithms, and the format of the displays will be established by the combat developer to support doctrine.

The Army is assimilating new operations doctrine at the same time it is developing and fielding elements of the ATCCS. In 1982 the Army dramatically changed its approach to warfighting with the publication of AirLand Battle doctrine. Recently, that doctrine was revised, primarily to clarify concepts, to address concerns of field users, and to provide a better tool for the education and training of the officer corps.⁴ The precepts contained in the 1982 version continue to form the basis for the execution of AirLand Battle.

There is concern, however, that tactical automation systems are inconsistent with AirLand Battle doctrine. The degree of emphasis placed on control, or stated another way, the degree of centralization of control, is a key issue. AirLand Battle doctrine requires freedom of operation for subordinates, delegation of authority, and leadership at critical points on the battlefield.⁵ Command and control systems that facilitate these aspects of decentralized control will contribute to the execution of AirLand Battle doctrine. Concern is voiced by those who see the increased use of automation and communications to reduce the degree of uncertainty as an attempt to centralize control.⁶ The

⁴General William R. Richardson, "FM 100-5: The AirLand Battle in 1986," Military Review, (March 1986), p. 11.

⁵Field Manual (FM) 100-5, Operations, (Department of the Army, Washington, DC, May 1986), p. 21.

⁶Martin Van Creveld, Command, (Cambridge, MA: Harvard University Press, 1985), p. 269. and Major Stephen E. Runals, Command and Control: Does Current U.S. Army Tactical Command and Control Doctrine Meet the Requirement for Today's High Intensity Battlefield?, (School of Advanced Military Studies, U.S. Army Command and General Staff College, Fort Leavenworth, KS, 2 December 1985), p. 37.

intent of this study is to determine if the degree of control implemented by the Army Tactical Command and Control System is congruent with the command and control requirements of AirLand Battle doctrine.

Before outlining the methodology, it is necessary to consider the assumptions, limitations, and definitions that are critical to this endeavor. Three assumptions were made during the conduct of the study: (1) that AirLand Battle doctrine would continue to be the Army's warfighting doctrine during the next decade and that its individual precepts would remain relatively constant; (2) that the organization and functions of corps, division, and brigade staffs would not change significantly during the fielding of tactical automation systems; and (3) that the ATCCS would be developed and fielded according to respective operational and organizational plans.

A number of limitations were imposed to restrict the scope of the study. The first limits the examination of functional requirements for tactical automation systems to those that support command and control at corps through brigade. Many automation systems have been fielded to support tactical operations, while numerous others are under development. This study will concentrate on the tactical command and control automation system's support of the commander and on its horizontal integration of the functional area control systems. Secondly, the organization of staff elements and tactical command and control facilities will not be examined. Thirdly, no attempt will be made to determine the survivability, reliability, or supportability, of the automation and communications systems under development. And lastly, this study will not analyze the capability of the proposed tactical communications architecture to support the ATCCS.

The definitions of **command and control**, **command and control system**, and **tactical command and control automation system** are provided for use throughout the report. The definition of **command and control** contained in the Joint Chiefs of Staff Publication Number 1 (JCS Pub. 1) will be applied. It states that **command and control** is: "The exercise of authority and direction by a properly designated commander over assigned forces in the accomplishment of the mission."⁷ There are many definitions of this phrase. Some of them focus on the leadership aspect of command; some focus on the balance of command and control functions in a continuous process that supports decisionmaking; and others focus on numerous other aspects. The JCS definition is used here because it emphasizes the role of the commander and the importance of the mission, both key aspects of AirLand Battle. This definition is also well recognized and used, if not thoroughly accepted.

The definition of a **command and control system** contained in JCS Pub. 1 is also used. It describes a **command and control system** as those "... facilities, equipment, communications, procedures, and personnel essential to a commander for planning, directing, and controlling operations of assigned forces pursuant to the missions assigned.(emphasis added)"⁸ Equipment and procedures represent those aspects of the command and control system that will be considered here.

Tactical command and control automation systems are considered to be those automation systems that directly support the function of command and control. They are composed of equipment and procedures and therefore represent only a portion of the command and control system. Tactically, they

⁷ Joint Chiefs of Staff Publication No. 1, Dictionary of Military and Associated Terms, (U.S. Joint Chiefs of Staff, Washington, DC, 1 April 1984), pp. 76-77.

⁸ *Ibid.*, p. 77.

represent a subset of the Army Command and Control System (ACCS), which extends from the mobilization, training, and sustainment base to the lowest levels of the battlefield.⁹

The methodology of the study is the last topic to be considered before approaching the research question. Examination of current literature concerning tactical command and control automation systems is confusing. Various automation systems which are in the field, on their way to the field, or under development, have been designed to support different versions of doctrine. When these systems are compared with command and control requirements of AirLand Battle doctrine, different conclusions may be drawn concerning their compatibility. This study considers doctrine and associated tactical command and control automation systems from three different periods: 1954 to 1973, 1974 to 1980, and 1981 to the present.¹⁰ In the first two cases the doctrine and automation systems are examined along with some of the major factors that influenced their development. The degree of centralized control is identified. AirLand Battle and the Army Tactical Command and Control System (ATCCS) are the primary subjects of the last period. The precepts of AirLand Battle doctrine are examined to identify generic requirements for decentralized tactical command and control. These requirements are compared with emerging tactical command and control automation systems to determine if they are consistent.

⁹Army Command and Control Master Plan: Analysis Report (U), Volume 1, U.S. Army Combined Arms Combat Development Activity, Fort Leavenworth, KS, February 1984, p. xxii. (SECRET)

¹⁰The end points of the periods represent major changes in concepts, doctrine, and tactical command and control automation systems.

EARLY BATTLEFIELD AUTOMATION SYSTEMS

This section examines the operational doctrine of 1954 and 1962, key concepts for operations in an atomic environment, and a number of the factors that influenced their development, as well as that of requirements for tactical automation systems. This section also considers some of the factors that affected centralization of control from the mid-1960's to the early 1970's, when the early battlefield automation systems were under development. Furthermore, each of the three major systems is briefly examined.

The 1954 version of Field Manual (FM) 100-5, Field Service Regulations - Operations, emphasized centralized control of subordinate operations. This doctrine, which was in effect when the need for major tactical automatic data processing (ADP) systems was identified, was the result of World War II and Korean War experiences and of the threat of war on the atomic battlefield.¹¹ In offensive operations, decentralized control would be implemented in those instances when the commander was unable to "...exercise timely and direct influence over the operation..."¹², but it was presented as the exception and not the rule. The doctrine for control and coordination of defensive operations also reflected this orientation. Procedures for decentralized control were identified, however, specific centralized procedures were stressed.¹³

¹¹Major Robert A. Doughty, The Evolution of US Army Tactical Doctrine, 1946-76, Leavenworth Papers No. 1, (Fort Leavenworth, KS, August 1979), p. 14-15.

¹²FM 100-5, Field Service Regulations-Operations, (Department of the Army, Washington, DC, 27 September 1954), p. 84.

¹³*Ibid.*, p. 126-127.

The emphasis on centralized control at the tactical level was continued by the Atomic Field Army-1 1956 and PENTANA studies, which were conducted during the mid-1950's. The factors that influenced these studies included (1) world-wide strategic missions, (2) constraints associated with strategic lift assets, (3) the threat of fighting outnumbered, (4) the combined mission and threat of fighting on an atomic (nuclear) battlefield, and (5) modern technology that would improve firepower, mobility, and control. These factors led to the development of small, self-contained, combined arms units capable of greater tactical dispersion. In the infantry division, five battle groups were created to replace the three larger regimental combat teams. Field tests had indicated that the division commander's span of control could be increased from three major subordinate commands to five if communications were improved.¹⁴ The battalion level of command was eliminated to reduce the time required to transmit information up and down the chain of command.¹⁵ Proponents sought a survivable division with increased strategic deployability and a streamlined command structure. Their efforts resulted in greater centralization of control.

The 1962 version of FM 100-5, Field Service Regulations-Operations, presented a more balanced treatment of the subject, but it did not significantly change the orientation on control. While decentralized control was identified as a desired technique, total coordination of effort was required to apply combat power effectively. This full coordination of effort required "...adequate means of control. ...secure communications, timely orders, and effective

¹⁴Doughty, Evolution, p. 16-17.

¹⁵Captain Jonathan M. House, Toward Combined Arms Warfare: A Survey of 20th-Century Tactics, Doctrine, and Organization, Combat Studies Institute Research Survey No. 2, (Fort Leavenworth, KS, August 1984), p. 154-155.

command facilities."¹⁶ The degree of centralization would be determined by a number of factors. Obviously, the most important of these was the type of operations, offensive or defensive, with the latter requiring tighter control.¹⁷ The emphasis on centralized control was evident when one considers the fact that the Army had chosen the defense over the offense as the key means of destroying the enemy's combat effectiveness. The focus on the defense of Western Europe and the belief that nuclear weapons could be used against enemy forces massed for the attack were two key reasons for this perception.¹⁸

During the late 1960's and early 1970's an extremely high degree of centralized control was achieved. The factors responsible for this phenomenon were numerous: utilization of the helicopter to increase the mobility of the commander; political and high level military interest in (and emphasis on) minor affairs; extensive use of statistics as a measure of tactical effectiveness¹⁹; friction between the superpowers and the need for the National Command Authority to limit escalation of conflict; the close relationship between political and military actions taken to secure our objectives in Vietnam; and the need to discriminate and engage enemy forces among innocent civilians.²⁰

Technology was also a very influential factor during this decade. Advances in sensors, tactical communications, and automation made a greater degree of centralization possible and therefore served as a catalyst for even greater

¹⁶FM 100-5, Field Service Regulations-Operations, (Department of the Army, Washington, DC, 19 February 1962), pp. 20, 51.

¹⁷*Ibid.*, pp. 69, 74-75.

¹⁸Doughty, Evolution, p. 25.

¹⁹van Creveld, Command, pp. 246, 252-253, 255.

²⁰Major General George E. Pickett, "Command and Control and Communications," Signal, January 1969, p. 16.

requirements. Surveillance devices capable of collecting vast amounts of data were available; improved communications offered greater capacity for transmitting information, decisions, and guidance; and computers offered the potential processing, storage, and display capability needed to make increased centralization of control possible. In 1970 these technologies led the commander of the U.S. Army Computer Systems Command to relate that "One can now perceive an evolving capability to locate and track in real time, anything that moves, perspires, broadcasts, makes a noise, shakes the ground, runs an engine, shoots a weapon, or is hotter or colder than its surroundings."²¹

Technology constraints also supported centralized control, but their influence may not have been as significant as the factors described above. In the late 1960's and early 1970's large scale integrated circuits and resulting smaller, survivable computers with increased processing capability were devices of the future.²² Developers thought in terms of mounting computers on wheels; the architectures of the three major systems were designed around mobile mainframes accessed by peripherals.²³ Combat developers foresaw tremendous advances in automation technology, but the potential decentralizing impact of these developments was not recognized by all. The Commander of the Computer Systems Command envisioned that improvements in automation would allow the the elimination of the field artillery battalion and division artillery headquarters. The fire support element at corps level would then be able to control all the artillery batteries directly.²⁴

²¹ As quoted by Brigadier General Wilson R. Reed, "Battlefield Data Automation," Signal, August 1970, p. 109.; attributed to Leonard Sullivan, Deputy Director of Defense Research and Engineering for Southeast Asia Matters.

²² James R. Mellor, "The Outlook for Tactical Command and Control," Signal, January 1968, p. 28.

²³ Brigadier General Wilson R. Reed, "Tactical ADP Systems," Military Review, June 1969, p. 78.

²⁴ *Ibid.*, pp. 83-84.

The initial determination that automation was required to support the field army resulted from the PENTANA study mentioned earlier. The Continental Army Command (CONARC) initiated development of an automated data processing system program to provide the necessary responsiveness to the conditions of nuclear warfare and to address the growing complexity of administration/logistics. Over 100 functions were identified as candidates for automation by CONARC, which articulated requirements in 1957.²⁵ In 1965 ongoing automation programs were consolidated into three major efforts:

"... the Tactical Fire Direction System (TACFIRE) for control of supporting artillery fires; the Tactical Operations System (TOS) for intelligence activities and control of the maneuver elements; and the Combat Service Support System (CS3) for control of the logistic and administrative support of the army in the field.(emphasis added)"²⁶

The Tactical Operations System (TOS) was developed to assist commanders and their staffs in decisionmaking and control of operations. In 1971 the system contained twelve applications relating to operations and intelligence functions.²⁷ The system, which was dependent upon master data bases located at division, corps, and field army headquarters, employed a centralized architecture:

The TOS, with its many input devices, allows information to flow into the data base as it occurs. The central data base, therefore, reflects the most current enemy and friendly situation (the real-time situation) and provides for more effective planning and decision-making at all levels."²⁸

The Tactical Fire Direction System (TACFIRE) applied automatic data processing to fire planning, target intelligence, fire control, and other field

²⁵Commanding General, U.S. Army Computer Systems Command, Combat Service Support System (CS3): Introductory Manual, (U.S. Army Computer Systems Command, Ft. Belvoir, VA, June 1969), pp. 1-3.

²⁶Reed, "Tactical ADP Systems," pp. 78-79.

²⁷Tactical Operations System: Basic System Description (Technical Summary), (U.S. Army Computer Systems Command, Fort Belvoir, VA, 15 May 1971), p. 1-1.

²⁸*Ibid.*, p. 1-2 to 1-3.

artillery support functions. It was also built around a central computer located at field artillery battalion, division artillery, or corps artillery level. Observer teams and other remote users were provided access to the system through the use of message entry devices. Requests for fire were keyed into the message entry device and transmitted to the battalion computer. A fire order was computed and displayed on the fire direction officer's control console. He alone had the option of changing data or transmitting the order for fire.²⁹

The Combat Service Support System (CS₃) was developed to improve accounting and reporting of logistic, personnel, administrative, and comptroller operations. At division level the system consolidated records in a central computer supported by five remote data terminals located at the Personnel Services Division (PSD), at the Division Materiel Management Center (DMMC), and in each brigade area. Input data, transmitted from the PSD or the three brigades to the DMMC, would be hand carried to the main frame for processing.³⁰

Development of these three systems was in progress as the period came to an end. In both concept and architecture they each reflected the capabilities and limitations of technology and the centralizing influences that were apparent in the doctrine. The Army would soon field CS₃, TOS would continue evolving until fiscal year 1980 when it would be refused funds and terminated, and TACFIRE would continue development into the 1980's and be fielded as the U.S. Army adopted AirLand Battle doctrine.

²⁹Reed, "Tactical ADP Systems," pp. 79-80.

³⁰Ibid., p. 82; CS3 Factsheet, (U.S. Army Computer Systems Command, Fort Belvoir, VA, May 1974), p. 1.

COMMAND CONTROL SUBORDINATE SYSTEMS (CCS2) CONCEPT

The second period of consideration was much shorter than the first, extending from the mid-1970's through 1980. It began with the development and publication of the 1976 version of FM 100-5, Operations, and ended in 1980 when the Army unveiled a decentralized tactical automation architecture.

In 1976 the Army published new operations doctrine that reflected concern for the realities of the first battle, the lethality of the modern battlefield, and the dominance of technology. The primary focus of the doctrine was evident in the description of the role played by leaders of large units: "There are many things that Generals ought to do. But there is one thing they **must do**: deploy their forces so that on the defense they are never outnumbered or outgunned more than 3:1 at the point and time of decision."³¹ The commander would exploit the mobility of his mechanized and armor units by moving reinforcements from reserves in the rear and by thinning out less threatened areas of the defense. However, the commander could accomplish this task only if he detected the enemy's main effort and made his decision to concentrate early enough. The emphasis on centralized control was clearly evident: "*In fast-moving mounted warfare, the requirement for continuous, reliable, secure communications is absolute.*"³²

The lethality of the modern battlefield also influenced the development of command and control concepts during this period. One of the primary reasons

³¹FM 100-5, Operations, (Department of the Army, Washington, DC, 1 July 1976), p. 3-5.

³²*ibid.*, p. 5-3.

for fielding Training Circular (TC) 101-5 in 1976 was a perceived need to reduce the vulnerability of the division command post. Concerns centered on the enemy's ability to locate command and control nodes and attack them with tube and rocket artillery, aviation, and unconventional warfare teams.³³ The circular recommended a reduction in the size of the current division command post by distributing functions, personnel, and equipment among the tactical command post, main command post, and division support area. The division main command post was also positioned further from the FLOT (outside the range of enemy tube artillery).³⁴

In 1977 and 1978 TRADOC began development of a series of concepts that would eventually lead to the development of AirLand Battle doctrine. The first major step in transitioning from the "first battle" orientation of the active defense was an expansion of the commander's focus to include successive battles.³⁵ A conceptual framework was developed that combined the elements of firepower, maneuver, support, and command and control. This framework considered two major forms of activity: Central Battle and Force Generation. Central Battle was oriented on the fight on the FLOT, the "... collision of battalions and brigades in a decisive battle."³⁶ Force Generation represented the actions of division, corps, and higher level commanders to anticipate Central Battles and the opportunities they provided. Force Generation efforts oriented on the concentration of combat power at decisive times and places to win Central Battles. Force Generation also included the actions to impede the

³³Training Circular (TC) 101-5, Control and Coordination of Division Operations, (Department of the Army, Washington, DC, April 1976), p. 3.

³⁴*Ibid.*, pp. 15-16.

³⁵Romjue, From Active Defense to AirLand Battle, pp. 23-27.

³⁶Battlefield Development Plan (U), (U.S. Army Training and Doctrine Command, Fort Monroe, VA, 17 November 1978), p. 3-2. (SECRET)

enemy's ability to concentrate his combat power.³⁷ The 1978 Battlefield Development Plan listed actions required to achieve the desired Force Generation command, control, and communications capability. They included developing priorities for the flow of information and defining a responsive and integrated command, control, and communications system for the battlefield.³⁸

In 1978 the requirement to interface tactical automation systems was identified in the Army Battlefield Interface Concept.³⁹ Battlefield functions were divided into the five areas of maneuver, administration/logistics, air defense, field artillery, and intelligence.⁴⁰ Five automation systems were identified as control systems for the battlefield functional areas: the Tactical Operations System (TOS), the Administration and Logistics Control System (ALCS), the TSQ-73 Missile Minder, the Tactical Fire Direction System (TACFIRE), and the All Source Analysis System (ASAS). The Tactical Operations System would also function as an executive command and control system, integrating the other control systems and providing a means for directing the Central Battle.⁴¹ A representation of the resulting centralized architecture is shown below.

³⁷ *Ibid.*, p. 3-4.

³⁸ *Ibid.*, p. 3-21.

³⁹ ABIC 78, p. 1-1.

⁴⁰ Dr. Eddie R. Fowler, Systems Analysis of the US Army's Command and Control System Architecture, draft, (Combined Arms Studies and Analysis Activity, Fort Leavenworth, KS, 31 August 1980), p. 2-6.

⁴¹ TOS CASE Study: Final Report, (The BDM Corporation, McLean, VA, 30 April 1980), p. II-4.

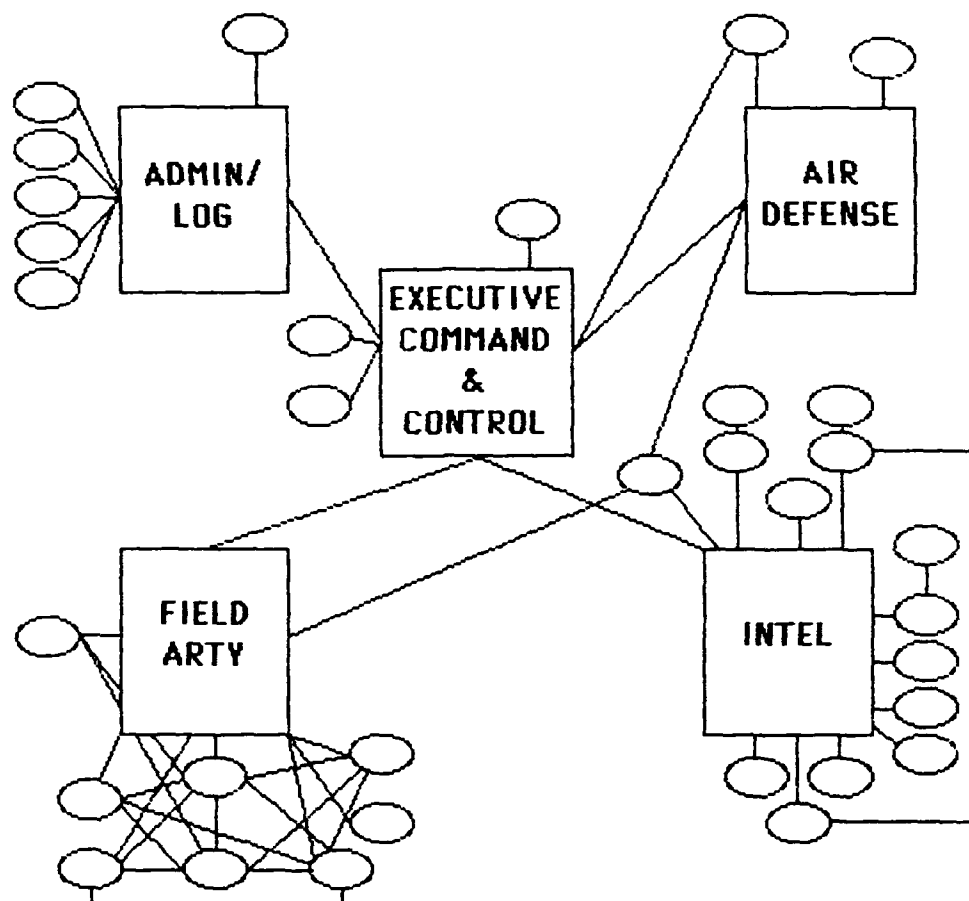


Figure 1. Early Version of the Executive Control Subordinate Systems (ECS²) Concept.⁴²

The commander's information requirements became a second key factor in the development of a tactical automation architecture during this period. In 1979 and 1980 major studies were conducted to determine the corps commander's information needs, the functional and subordinate tasks required to produce the information, and the system interfaces necessary to provide the information to the commander.⁴³ In July 1980 a set of information require-

⁴²Fowler, *Systems Analysis*, p. 2-7.

⁴³Division Commander's Critical Information Requirements (CCIR), (U.S. Army Combined Arms Combat Development Activity, Fort Leavenworth, KS, 30 April 1985), p. B-1 to B-3.

ments was presented at the Fifth Battlefield Automation Appraisal (BAA V). The items represented the minimum essential information that commanders would require for decisionmaking. The battlefield functional areas contained those elements of information that were considered "...key to the successful accomplishment of the commander's tasks."⁴⁴ The resulting list of eighty-five information elements provided the basis for the exchange of information between major tactical automation systems.

A concept for evolving an integrated automation architecture was created in 1980. The General Accounting Office reviewed the TDS program in late 1979 and recommended that system development should not be continued. Program management problems included a failure to finalize requirements, the linkage of system design to preselected hardware and software, and a failure to consider the severe environment in which the system would be operated.⁴⁵ When the TDS program was killed in fiscal year 1980, a fifth control system was added for the maneuver functional area and the Executive Control Subordinate System (ECS²) Concept became a decentralized architecture (Figure 2).⁴⁶ The concept was presented with the information requirements at the BAA V as the "...means to extract, process, and disseminate this critical information rapidly."⁴⁷ Following the BAA V the name was changed to the Command Control Subordinate Systems (CCS²) Concept.

⁴⁴Executive Control Subordinate System (ECS²) Presentation to the Fifth Battlefield Automation Appraisal (BAA V), (U.S. Army Combined Arms Combat Development Activity, Fort Leavenworth, KS, July 1980), p. 6.

⁴⁵Report by the U.S. General Accounting Office, LCD-80-17, (U.S. General Accounting Office, Washington, DC, 20 November 1979), p. 1.

⁴⁶Fowler, Systems Analysis, p. 2-6.

⁴⁷Presentation to BAA V, p 7.

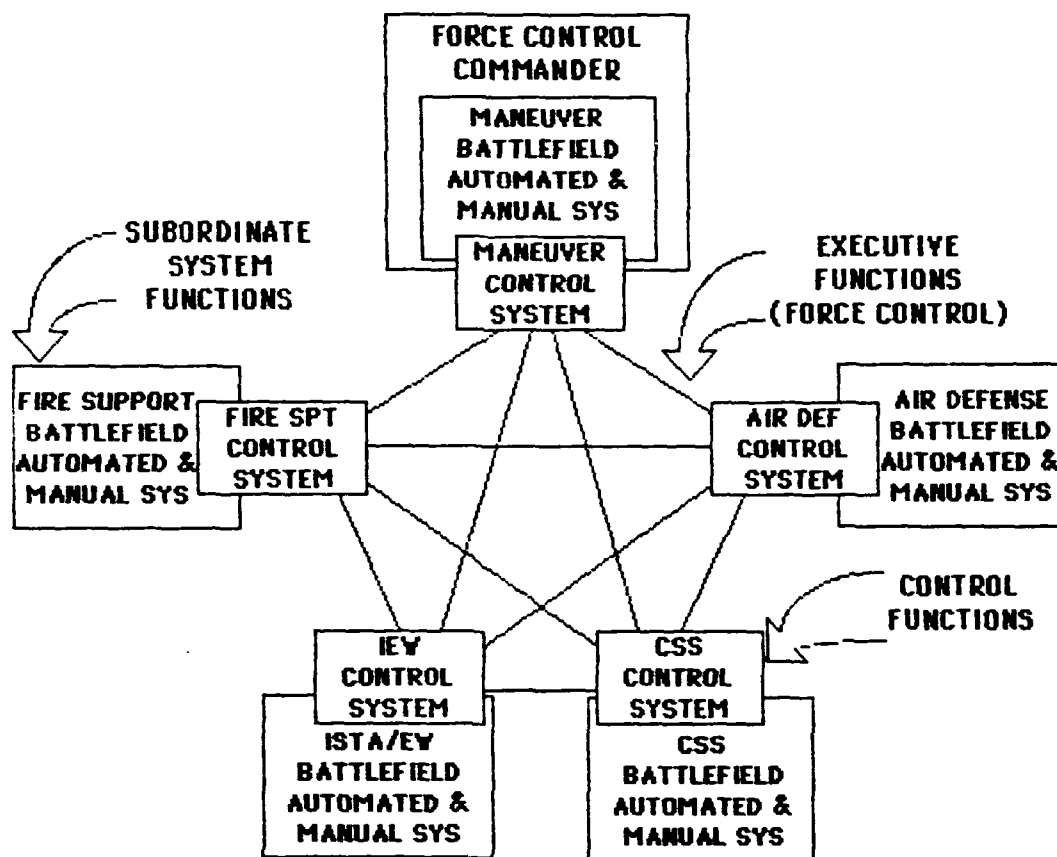


Figure 2. Single Echelon Representation of the ECS² Concept⁴⁸

The new concept was based on the integration of the five battlefield functional areas, which were redesignated as: Maneuver, Combat Service Support, Air Defense, Fire Support, and Intelligence and Electronic Warfare. Each of these areas contained an operational facility (OPFAC - a command post or operations center) that processed information. The division artillery tactical operations center is an example of an OPFAC.⁴⁹

Each of the OPFAC's processed three distinct types of information within their respective functional areas. Technical data products represented the

⁴⁸Fowler, Systems Analysis, p. 2-8.

⁴⁹Presentation to BAA V, p. 11.

lowest level of information from which decisions were made. The controlled supply rate of TOW missiles or the location of an enemy emitter are examples. Technical information was processed to create staff information products like the status of ammunition within the functional area or the location of a critical enemy unit or weapon system. These elements of information were then processed further to produce command related information, which in this case might be the status of supply for the entire unit or the probable intentions of the enemy commander.⁵⁰

Subordinate systems operated within battlefield functional areas at the lowest level of the architecture. They generated technical data and for that reason rarely provided information that directly supported the commander's decisionmaking process. At the next higher level, control systems performed three functions: they supported the command and control process of the battlefield functional area commander, they exchanged information with other functional control systems, and they produced information critical to the force level commander's decisionmaking process. At this time systems like TACFIRE and TSQ-73 were dropped from consideration as control systems because they could not perform these three functions.⁵¹ At the highest level, the executive control system supported the force level commander's information needs and the exchange of information between functional control systems.⁵²

⁵⁰ *Ibid.*

⁵¹ Each of these systems provided limited support of the battlefield functional area commander's command and control process.

⁵² *Ibid.*, pp. 13-15.

ARMY TACTICAL COMMAND AND CONTROL SYSTEMS (ATCCS)

The U.S. Army Training and Doctrine Command (TRADOC) was in the process of revising FM 100-5 as the BAA V convened to consider the CCS² Concept and the key elements of information. This process represented the evolution of a series of concepts and studies following the 1978 Battlefield Development Plan.⁵³ In March of 1981 TRADOC published two operational concepts, entitled the AirLand Battle and Corps Operations-1986, that would influence the development of command and control systems. The AirLand Battle concept was intended to provide an umbrella concept describing TRADOC's perception of the battlefield of the 1980's, while the Corps 86 concept was to provide a broader and more detailed look at operations on the AirLand Battlefield.⁵⁴ The operational concept for AirLand Battle was a description of deep attack.

The Corps 86 concept addressed command, control, and communications in some detail focusing on the decisionmaking process, the fight forward of the FLOT, and centralized control of the battle.⁵⁵ The corps commander would position himself where he could best direct the operations of the corps. No specific location was identified, but the corps tactical and main command posts were identified as possible choices. Control would be accomplished

⁵³Romjue, From Active Defense to AirLand Battle, pp. 33-44.

⁵⁴TRADOC Pamphlet 525-5, Operational Concepts for the AirLand Battle and Corps Operations - 1986, forward, (U.S. Army Training and Doctrine Command, Fort Monroe, VA, 25 March 1981).

⁵⁵*Ibid.*, pp. 31-33. This and many of the other ideas concerning command and control were built upon the TRADOC Pamphlet 525-2, Operational Concept for Army Tactical Command and Control, dated 20 June 1980.

through these command posts and a third located in the rear.⁵⁶ The centralizing influence of deep attack with its requirement to see and strike deep was apparent.

The authors of the concept showed a great concern for the enemy's ability to disrupt control of the corps by attacking the command posts. The combination of a viable enemy threat and their emphasis on centralized control forced the authors of the concept to reduce the command posts' vulnerability. Recommended options to increase the survivability included concealment, reduction in size and signature, duplication of functions, hardening, and wide dispersion. The concept recommended a dispersed command post concept that combined at least three of the options.⁵⁷

A dissenting view was presented in the November 1981 Military Review, a command and control special issue. Its author believed that the active defense and the concept for the attack of follow-on echelons created a "... heavy reliance on accurate and timely intelligence and friendly status information as well as a system for the near instantaneous promulgation of execution orders - a highly developed command and control system."⁵⁸ If the system was not there the commander would lose the battle because he would be unable to execute the tactics. This was critical because the enemy's capability to degrade the system seriously challenged its reliability. Two solutions were available: (1) make the command and control system more survivable as described above or (2) "... revise the tactics so that there is little reliance on the staff or the information and the communications network."⁵⁹ System developers were

⁵⁶Ibid., p. 33.

⁵⁷Ibid., p. 34.

⁵⁸Dennis H. Long, "Command and Control - Restoring the Focus," Military Review, November 1981, p. 47.

⁵⁹Ibid.

orienting on the former, while the authors of operations doctrine were considering the latter.

The precepts contained in the 1982 version of FM 100-5 gave the impression of a need for decentralized command and control, but in general terms which did not significantly decentralize doctrinal procedures for control of tactical operations. The discussion of the four tenets of initiative, depth, agility, and synchronization provide examples of this point. The requirement for independent actions and exploitation of opportunities, as part of initiative, give a hint of decentralized control, but nothing specific. The discussion of agility did, however, emphasize the requirement for flexible organizations, an issue that spoke strongly for decentralized control. On the other hand, depth and synchronization appeared to require greater control of tactical operations, especially synchronization with "... an all-prevailing unity of effort throughout the force." as its goal.⁶⁰ The doctrine's specific statements concerning command and control treated the subject of decentralization lightly. While the threat of electronic warfare, the vulnerability of command posts, and the nature of mobile combat demanded initiative in subordinate commanders, that was as strong as the message was presented.⁶¹

While members of the Command and General Staff College (CGSC) were rewriting FM 100-5 in 1981, personnel in the Combined Arms Combat Developments Activity (CACDA) were taking steps to implement the CCS² Concept. Their first major steps were the identification of the Force Level Information Requirements Plan (FLIRP) and the development of the SIGMA Concept. The FLIRP was developed from the 85 information elements identified

⁶⁰FM 100-5, Operations, (Department of the Army, Washington, DC, 20 August 1982), pp. 2-2 to 2-3.

⁶¹*Ibid.*, p. 1-3.

earlier in the BAA V to provide a basis for defining the interface requirements between the functional control systems. The SIGMA Concept was created to provide the means to integrate the five functional systems within the CCS² Concept and support the force level commander. It represented a combination of force level control and maneuver control functions.⁶² The Maneuver Control System (MCS) would provide an interim version of force level control by placing MCS devices in the other OPFAC's until their unique functional control systems were fielded and capable of interfacing horizontally.

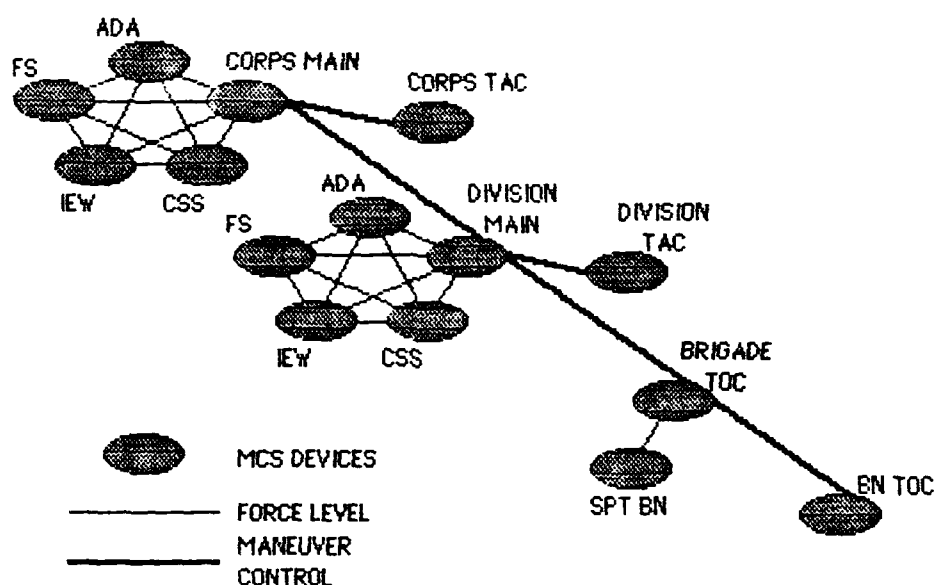


Figure 3. Maneuver Control and Interim Force Level Control⁶³

Initially, the Maneuver Control System was oriented on vertical integration in its implementation of the interim force level and maneuver control

⁶²Division Commander's CCIR, p. B-4.

⁶³Operational and Organizational (O&O) Plan for the Maneuver Control System (MCS), (U.S. Army Training and Doctrine Command, Fort Monroe, VA, 30 June 1982), p. 4-2. The operational and organizational plan provided additional devices for key staff elements at corps and division level. The rear command post was included in the architecture in a later version of the plan.

capabilities. The MCS Operational and Organizational Plan, dated 30 June 1982, described the interfaces with the other battlefield functional areas. However, the emphasis on the vertical maneuver function became clear when the relative values assigned to the links between nodes were considered. The vertical link from the corps main to the division main was almost three times as valuable to overall system operations as a horizontal link between the corps main command post and the other OPFAC's; division to brigade nearly four times as valuable as a horizontal link at division level.⁶⁴

Procedures for processing and storing information reflected centralized control. Characteristic of previous doctrinal and conceptual emphasis on the command post, the Maneuver Control System device at the corps main command post was considered "...the hub of the corps level system..." It maintained the corps' "...consolidated operational and planning data bases."⁶⁵ Information would be processed and stored centrally as part of the MCS function.

The commander's information requirements were questioned again at the 1984 Command and Control System Program Review (SPR). One of the topics, the Commander's Critical Information Requirements (CCIR), was reminiscent of the 1980 BAA V. A set of twenty-five information items, which were selected from the FLIRP, were presented for consideration as CCIR. The Vice Chief of Staff directed that the commander's critical information needs be re-examined, that the twenty-five items be considered as standards for CCIR, and that CCIR be incorporated into doctrinal literature for instruction in TRADOC schools and implementation throughout the force.⁶⁶

⁶⁴ These factors were derived from an analysis of the values assigned to network links in the MCS mission profile. Ibid., p. 4-1 to 4-2.

⁶⁵ Ibid., p. 3-4.

⁶⁶ Division Commander's CCIR, p. A-1.

The division level CCIR were identified following a survey of the commanders of all active component divisions and corps and a general officer level working group.⁶⁷ The survey participants were asked to review the strawman CCIR of twenty-five information elements and the FLIRP and then to determine the critical information they required for decisionmaking. Their responses were analyzed to identify trends and insights to guide the working group, which was tasked to identify the final set of CCIR. The working group identified eight information categories (command guidance, battlefield geometry, maneuver, fire support, intelligence, air defense, combat service support, and combat support) with subordinate critical information items.⁶⁸ The results were published in Field Circular 101-55, Corps and Division Command and Control, and provided to combat developers.

The interoperability of tactical command and control automation systems has also been a key issue during the past two years. Horizontal integration of the functional control systems was addressed at the 1984 System Program Review, as it had been at the BAA V. The decision was made during the review to designate proponents for the battlefield functional area nodes of the CCS² Concept both in TRADOC and the Army Materiel Command. A system engineer was also designated as the system integrator for the materiel development community, while the commander of the Combined Arms Center would continue to integrate activities within the combat development community.⁶⁹

In April 1985 the Army Development and Employment Agency's Distributed Command and Control System (DCCS) began merging with the Maneuver Control

⁶⁷The commandants/commanders of the the TRADOC schools and centers were also surveyed

⁶⁸Division Commander's CCIR, p. 7 and Appendix F: CCIR Product.

⁶⁹Command and Control System Program Review (C2SPR) II - IPR: Status Data, Recommendation 53, U.S. Combined Arms Combat Developments Activity, Fort Leavenworth, KS, 20 Jan 1985.

System (MCS). The DCCS, which is utilized by the 9th Infantry Division, is a user developed variant of the MCS that was created in an evolutionary test bed. The merger increased the emphasis on horizontal integration, support for the commander, and distribution of critical information.⁷⁰ The CCS² Concept stressed horizontal integration, but neither the concept nor the 1982 Maneuver Control System Operational and Organizational Plan addressed the interface between the MCS, the coordinating staff, and the other battlefield functional areas. The DCCS provided devices to the coordinating staff to help improve horizontal integration at division level. The 1985 MCS O&O Plan reflected the Distributed Command and Control System's influence in this area.⁷¹

The DCCS also influenced the identification of critical decision information and the determination of where this information should be maintained. The 1985 MCS O&O Plan adopted a set of information displays used within the DCCS to convey critical information concerning operations, intelligence, and battle resources. These displays, referred to as the Commander's Situation Report (SITREP), provide a situation map with key overlays, an intelligence summary and analysis of avenues of approach, and the status of critical battle resources.⁷² The Commander's SITREP can be distributed and maintained much easier than the CCIR, which today represent the force level (or command) data base. The CCIR are required by the staff and the functional control systems, but they are now considered too detailed and too numerous to meet the commander's needs. By mid-1988 the MCS will maintain the Commander's

⁷⁰Interview with Mr. Robert Seymour, C3I Directorate, Combined Arms Combat Developments Activity (CACDA), Fort Leavenworth, Kansas, 14 November 1986. The merger will be complete in 1989 when MCS equipment is fielded to the 9th ID.

⁷¹Interview with Major G. Chesley Harris, C3I Directorate, Combined Arms Combat Developments Activity (CACDA), Fort Leavenworth, Kansas, 8 October 1986.

⁷²Initial Force Level Control System (IFLCS) Presentation, (U.S. Combined Arms Combat Development Activity, Fort Leavenworth, KS, 30 December 1986).

SITREP at the tactical, main, and rear command posts and will distribute portions of it higher, lower, and horizontally to the other OPFAC's.⁷³

The emphasis on horizontal integration continued as the requirements and development plans for the systems that would implement the CCS² Concept were reviewed during 1985. All requirements for tactical command and control automation systems were examined. System functionality, interfaces, and distribution quantities were key issues. Software requirements were reviewed to identify common applications and proponents were identified to manage their development. The greatest commonality was in the area of force level control functions. Hardware requirements were compared to determine if they were consistent in the areas of survivability and functionality. Requirements for a set of common devices were proposed to improve interoperability and supportability through commonality of hardware across the force.⁷⁴ A requirement for the Army Tactical Command and Control System (ATCCS) was recently initiated to implement the recommendations of the review.

The ATCCS represents more than the vehicle for fielding common hardware and software, it will integrate the functional control systems and field the force level control system. The requirement for the ATCCS takes an important step towards horizontal integration by placing a formal requirement on the developers of the functional control systems, outlining the functions that must be performed to support force level control. Current battlefield functional area control systems include the Maneuver Control System (MCS); the Advanced Field Artillery Tactical Data System (AFATDS); the All Source Analysis System

⁷³Ibid.; Seymour, 14 November 1986.

⁷⁴Major Chess Harris, "BC2SR," C2Mug Bulletin, January 1986, pp. 1, 10.

(ASAS); the Forward Area Air Defense Command, Control, and Intelligence (FAAD C²I) System; and the CSS Control System (CSSCS).⁷⁵

AirLand Battle doctrine was revised while the CCIR were being identified and while requirements for tactical command and control automation systems were under review. The doctrine contained in the 1986 version of FM 100-5 clarifies a number of concepts contained in the earlier version, but none more thoroughly than command and control. It provides a much more decentralized view of control. The tenets again offer examples of this point. The discussion of individual initiative requires "...a willingness and ability to act independently within the framework of the higher commander's intent." It also states that "In the chaos of battle, it is essential to decentralize decision authority to the lowest practical level because overcentralization slows action and leads to inertia.(emphasis added)"⁷⁶ The discussion of agility attacks a different aspect of the issue. It stresses that commanders must be prepared to accept risk and commit forces without complete information. Attempts to build a complete picture of the situation will relinquish valuable opportunities.⁷⁷ The discussion of synchronization de-emphasizes the centralization of control that had been associated with that function. Thorough understanding of the commander's intent and well conceived, rehearsed, standard procedures are identified as means of reducing synchronization's dependence on explicit coordination. "In the chaos of battle, when communications fail and face-to-face coordination is impossible, such implicit coordination may make the

⁷⁵The Family of Army Tactical Command and Control Systems (ATCCS) Operational and Organizational (O&O) Plan, draft, (U.S. Army Combined Arms Combat Developments Activity, Fort Leavenworth, KS, 6 October 1986), pp. 1, 4.

⁷⁶ FM 100-5, Operations, (Department of the Army, Washington, DC, 5 May 1986), p. 15.

⁷⁷Ibid., p. 16.

difference between victory and defeat. . . The less synchronization depends on active communications, the less vulnerable it will be."⁷⁸

The manual's treatment of command and control also emphasizes decentralized control. The basic approach is offered in this statement: "The command and control system which supports the execution of AirLand Battle doctrine must facilitate freedom to operate, delegation of authority, and leadership from any critical point on the battlefield."⁷⁹ The authors of the doctrine believe that freedom to operate begins with the plan. It should establish the commander's intent, the concept of operations, and responsibilities for subordinates, while providing the greatest freedom to subordinate leaders. The plan must be flexible enough to allow subordinates to vary from it if they are pursuing the commander's goals. As mentioned above, the doctrine also requires that commanders be able to exercise leadership from any critical point on the battlefield. To support this "...the command and control system must permit tactical leaders to position themselves wherever the situation calls for their personal presence without depriving them of the ability to respond to opportunities or changing circumstances with the whole force."⁸⁰ This requirement goes beyond the concept of having the staff operate within the commander's intent with the same initiative as subordinate commanders. This issue concerns the the commander's ability to influence the entire force directly. Other aspects of the command and control system besides personnel and procedures must be employed to support this requirement.

⁷⁸ *Ibid.*, pp. 17-18.

⁷⁹ *Ibid.*, p. 21.

⁸⁰ *Ibid.*, p. 22.

AIRLAND BATTLE REQUIREMENTS

The focus of the command and control system has been, and will continue to be, the reduction of uncertainty for the decisionmaker.⁸¹ Its components, the personnel, procedures, facilities, equipment, and communications, are intended to assist the commander in planning, directing, and controlling the operations of the force. Their actions represent an attempt to reduce the commander's uncertainty concerning the outcome of ongoing and future operations. There are two basic methods of dealing with this uncertainty. One alternative is to increase the command and control system's information processing capacity. The other approach is to design the Army's organizations and doctrine in a manner that permits execution of operations with less information.⁸² The development and fielding of tactical command and control automation systems has taken the former approach, while current doctrine has taken the latter. AirLand Battle doctrine has been designed to limit the "...reliance on the staff or the information and communications network."⁸³

The method for dealing with uncertainty should not be limited to one of the alternatives identified above. Tactical command and control automation must complement a doctrine that limits reliance on the command and control system's capacity to process information. Examination of the doctrine has shown that tactical command and control automation systems are required to

⁸¹ van Creveld, Command, p. 268.

⁸² *Ibid.*, p. 269.

⁸³ Long, "Restoring the Focus," p. 47.

facilitate the decentralization of decisionmaking, a task which may be counter to the original reasons for their development. This study views decentralized control in two dimensions. The first is related to the echelon at which decisions are made, while the second concerns the flexibility provided to the decisionmaker. If tactical command and control automation systems do not allow for both types of decentralization, the procedures they implement will conflict with attempts to execute the doctrine.

The first aspect of decentralization involves the provision of information to subordinate commanders, the amount of information required by decision makers, and requirements for horizontal integration. The first of these issues concerns the information subordinates require to make effective decisions. AirLand Battle doctrine pushes decisionmaking authority to the lowest practical level to speed the decisionmaking process and ultimately increase the agility of the force. To achieve these objectives the doctrine requires that subordinate commanders be willing and able to act independently.⁸⁴ A thorough understanding of the intent and the concept of operations is essential. This understanding should be provided by the plan, but that is only the starting point. Conditions will change, unexpected situations will arise, assumptions may be proven false, and the concept may have to be changed. Unfortunately, the subordinate commander and his staff may not be aware of the changing conditions.

Information critical to decisionmaking, FLIRP and CCIR data, has been identified and will be available to the system. It will be stored at different locations within a command to provide for continuity of operations in the event the command post(s) is lost or becomes ineffective.⁸⁵ In any given situation a

⁸⁴FM 100-5, Operations, p. 15.

⁸⁵An Evaluation of Force-Level Information Exchanges, Fort Monmouth, Center for Systems Engineering and Integration, March 1986, p. 2-6.

subset of this information is extremely important because it represents those items that would dictate a change in the concept or perhaps even the commander's intent. If this information were provided to subordinate commanders and their staffs and updated as the situation changed it would improve their agility by allowing them to make better informed decisions without explicit coordination with higher headquarters. As a result, the degree of overall uncertainty would be reduced. First requirement: Information considered most critical to the commander's decisionmaking process should be provided to subordinate commanders.

The second issue concerns the information that is provided to commanders to support their decisionmaking. Compared to earlier concepts and doctrine, AirLand Battle will reduce the amount of information required by decisionmakers. For example, the decisionmaking process will be far less sensitive to the amount of information provided to higher headquarters concerning the situation if the commander is willing to entrust a subordinate with the authority to initiate the counterattack, or if he intends to initiate it himself at the critical point. Information concerning friendly, enemy, and common aspects of the situation will be required by the decisionmaker who triggers the counterattack, but it will not have to be provided up through the chain of command in the detail and at the rate required for a timely and accurate decision at a higher echelon.

When information requirements are identified they must be minimized. One of the reasons for developing tactical command and control automation systems has been to assist the commander and his staff in collecting, processing, evaluating, presenting, and disseminating information more rapidly to

allow more time for acting, thereby improving agility.⁸⁶ Automation also offers the potential of reducing the level of uncertainty by collecting and processing more information in less time than the manual system. A problem will develop if the collection or use of this information jeopardizes the decentralized approach of the doctrine. The capability, if used improperly in peacetime when there is no threat to the components of the command and control system, can push decision thresholds back to higher echelons. Then, given the enemy's ability to disrupt the command and control process in wartime, agility will be at risk. Second requirement: Identify the minimum amount of information critical to decentralized decisionmaking.

The third issue created by decentralized decisionmaking concerns the integration of battlefield functional areas. If decisionmaking is going to be decentralized and if commanders at lower levels are going to demonstrate initiative and act independently, they must be able to synchronize combined arms activities at their echelon. This requires effective horizontal integration. AirLand Battle doctrine recognizes that the chaos of battle will often preclude commanders from effectively exercising direct control of subordinate units. Under these conditions it will be impossible for the combined arms of one echelon to be synchronized from above. Horizontal integration will be more important to the accomplishment of the maneuver commander's mission than vertical integration. Third requirement: Tactical command and control automation systems must emphasize horizontal integration.

The second dimension of decentralization concerns the manner in which the command and control system supports the commander; where critical infor-

⁸⁶ Operational and Organizational Plan for the Maneuver Control System (MCS) (Volume II), Draft Plan, (U.S. Army Combined Arms Combat Developments Activity, Fort Leavenworth, KS, 24 May 1985), p. 1.

mation is made available to the decisionmaker and where he can exercise control of his unit as a whole. AirLand Battle doctrine requires a command and control system that increases rather than decreases the commander's flexibility by allowing him to control his unit from any critical point on the battlefield.⁸⁷ This is certainly not a new objective or requirement. Every commander wants increased flexibility, but the need is relative to the doctrine. The commander's desire to locate himself at the critical point is also common; it is the location of the critical point that has changed. Concepts and doctrine from the late 1950's through the 1970's implied that the command post, the hub of the command and control system, often represented that critical point. Given the expected intensity of operations and the enemy's ability to interrupt command and control, the location of the critical point is less likely to be the decisionmaker's command post. Wherever he is located (a division or corps commander in a brigade area for example) he requires the ability to control the force. Fourth requirement: The force level control system must support the commander wherever he may position himself on the battlefield.

It is possible at this point to examine the compatibility of proposed tactical command and control automation systems and the doctrine they must support. This section examines the Army Tactical Command and Control System (ATCCS) to determine if the four requirements identified above would be satisfied. The Maneuver Control System's implementation of interim force level control is also considered. The first issue is the requirement to provide critical information to subordinate commanders. The draft ATCCS Operational and Organizational Plan requires that battlefield functional area control systems be capable of accessing and/or maintaining "...the command data base

⁸⁷The requirement for the commander to be able to influence the activities of the whole force from any location on the battlefield also emphasizes vertical centralization of control.

and maneuver control system software. . . (when required to function as the force headquarters).⁸⁸ The data base will provide information to support decisionmaking, while the MCS software will support decisionmaking and control of friendly operations. The reference to functioning as the force headquarters clearly indicates that critical information will be distributed for purposes of continuity of operations. This information is not intended to improve decisionmaking by other battlefield functional area commanders. This procedure is intended to facilitate re-establishment of centralized control if the command post is lost. The operational and organizational plan also does not address the provision of all or a portion of this data base to subordinate commanders for either purpose. The Maneuver Control System provides a good example of how this information would be distributed. When the MCS data base is fielded in mid-1987 users will be able to establish standing requests for information from other devices within the system. When specific items in the data base are updated a report containing the requested information will be created and transmitted to the subscriber.⁸⁹ Commanders and their staffs would be able to pull information through the system by accessing the higher commander's data base in this manner. As mentioned earlier, in mid-1988 the MCS will supplement this capability through distribution and maintenance of the Commander's SITREP.

⁸⁸ Annex B, "Operational and Organizational Plan for The Family of Tactical Command and Control Systems (ATCCS)," to letter HQDA(DAMO-FD), Washington, DC, 9 December 1986, subject: The Army Tactical Command and Control Systems (ATCCS) Required Operational Capability (ROC), p. B-3. Note the use of the term "command data base" instead of "commander's data base". This reflects current efforts to replace the FLIRP with the CCIR, which constitute the force level or command data base.

⁸⁹ O&O Plan for the MCS, p. D-1. The MILSPEC components of the system are being fielded at this time with limited software functionality. Additional software releases are scheduled on a yearly basis to implement the merger of MCS and DCCS and to continue the evolutionary development of horizontal integration.

The second requirement concerns the amount of information provided to support the commander's decisionmaking process. The Commander's SITREP will support decentralized decisionmaking more effectively than the command data base. It will be more effective because it represents a subset of the information available in the data base and because it consolidates the information into a small number of displays. The majority of the information contained in the Commander's SITREP is summarized from numerous inputs with subjective and objective evaluations of friendly and enemy capabilities. The status of personnel; supply classes I, III, IV, V, and VII; and pacing items are described in detail in a set of charts that amplify the data contained in the battle resource summary display; however, the distribution of this detailed resource information for the force as a whole is limited to maneuver command posts.⁹⁰

The third requirement is for horizontal integration. The lack of effective integration between automation systems has been recognized as a problem for many years. The Command Control Subordinate System (CCS²) Concept has emphasized the need to exchange information between the battlefield functional areas since its conception. The ATCCS Operational and Organizational Plan continues this orientation by requiring that each battlefield functional area control system "Exchange standard data elements in standard formats with other BFA [battlefield functional area] control systems..."⁹¹ Its emphasis is clearly on horizontal integration. The MCS implementation of an interim force level control capability emphasizes vertical integration, but it will

⁹⁰ FLCS Presentation.

⁹¹ HQDA letter, subject: ATCCS ROC, 9 December 1986, p. B-2.

increase horizontal integration significantly by extending the system to the each battlefield functional area at corps and division.

The last requirement concerns constraints placed on the commander, possibly limiting the locations from which he can receive information from the system and direct the force as a whole. Today, when a commander is away from his command and control facilities he controls the force through access to the communications network. His decisions are supported by the information he brings with him; personal observations at the critical point; information provided by a subordinate commander and staff, if available; and whatever he can obtain through communication with his commander, his staff, or others. The ATCCS Operational and Organizational Plan specifies that "ATCCS implementation must not restrict the commander's mobility on the battlefield nor can it limit his ability to access the information he deems critical to command the force."⁹² Unfortunately, the plan only describes the distribution and maintenance of the command data base. In the MCS the Commander's SITREP will be maintained at the three maneuver command posts and major portions of it will be replicated in each of the other four OPFAC's, at higher headquarters, and in major subordinate commands. This capability will vastly improve the commander's flexibility by providing the information to senior and subordinate commands that would represent numerous additional nodes where the commander may position himself. This interim force level control capability should provide the basis for the evolutionary development of a comparable capability in the ATCCS.

⁹²*Ibid.*, p. B-4.

CONCLUSIONS

Over the past thirty years operations doctrine has generally emphasized centralized control. The threat of atomic war, a defensive orientation, and the capabilities and limitations of technology combined with other factors to stress centralized control from the mid-1950's to the early 1970's. The active defense and the concepts of Central Battle and Force Generation extended the trend because of a continued orientation on defensive tactics, an increased reliance on technology, and an ongoing concern over force ratios. Even the concepts that led to the development of AirLand Battle doctrine continued to stress centralized control. However, the doctrine published in 1982, and later updated in 1986 reflected a major shift towards decentralization, a shift that became evident in the 1986 version of the doctrine.

The degree of centralized control inherent in tactical automation systems' also decreased significantly during the same period. The early battlefield automation systems initiated during the 1950's and 1960's reflected a high degree of centralized control because of the factors mentioned above. While the doctrinal trend continued during the mid- to late 1970's, the tactical automation architecture began a move toward decentralization with the creation of the Command Control Subordinate System (CCS²) Concept. The factors that influenced its development included: (1) attempts to identify the commander's critical information requirements, (2) a need to share information between different tactical automation systems, and (3) concerns over the survivability

of the command and control system. Movement toward decentralization continues today with the development of the Army Tactical Command and Control System (ATCCS).

Conclusions concerning the compatibility of tactical command and control automation systems and current operations doctrine must be based on the systems' ability to support decentralized decisionmaking. AirLand Battle doctrine requires: (1) that subordinates are able to act independently; (2) that commanders are prepared to commit forces without waiting for enough information to ensure certainty; (3) that synchronization depend as little as possible on explicit coordination; and (4) that commanders are capable of influencing the operations of the entire force from any location on the battlefield. These aspects of the doctrine must be supported by tactical command and control automation systems or there will be a conflict in procedures.

Tactical command and control automation systems' potential to support AirLand Battle's decentralized control cannot be measured by examining the Tactical Fire Direction System. It was eliminated from consideration as a battlefield functional area control system when the Command Control Subordinate System (CCS²) Concept was developed for the BAA V. It was redesignated as a subordinate system because it could not fully support the command and control functions of the battlefield functional area commander, exchange information with other battlefield functional area control systems, or produce information critical to the force level commander's decisionmaking process. The Tactical Fire Direction System was not designed to support the CCS² Concept or decentralized control required by AirLand Battle doctrine.

The interim force level control capability implemented by the Maneuver Control System will support decentralized decisionmaking. This is primarily

through the manner in which this version of the force level control system will support the commander's information needs. Its management of information at the force level will be based upon requirements that reflect technology and threat dominated concepts of the late-1970's, namely the FLIRP elements which form the basis for many of system's standard messages. However, the Commander's SITREP reduces the amount of information designated as critical to the commander from that contained in the FLIRP and the CCIR.

The interim force level control system will also increase the division and corps commanders' flexibility significantly. Portions of the situation map, intelligence status, and friendly resources displays will be maintained in locations mentioned earlier. Commanders will be able to access the system at least as low as maneuver brigade level, where they will be able to review their SITREP, request additional information if necessary, and issue directives to the force.

The Commander's SITREP will be distributed for survivability reasons. This is a point where the MCS is not consistent with AirLand Battle doctrine's decentralized control as defined in this study. This critical information will not be pushed down the chain of command to support decentralized control, but for a different purpose. Decentralized decisionmaking will be supported in the end because of the flexibility of the system and by chance, not by design.

The Army Tactical Command and Control System will increase the level of horizontal integration, but it is not totally compatible with the command and control requirements of AirLand Battle doctrine. The ATCCS will improve horizontal integration by extending force level control to brigade level, by fielding common hardware and software, and by emphasizing the integration of functional control systems. However, the provision of critical information to

subordinates on a regular basis and the creation, distribution, and storage of information critical to the commander are not addressed. Presumably, the management of this information would be accomplished within the maneuver functional area; however, it is a force level control issue which should be addressed within the ATCCS.

The relationship between tactical command and control automation systems and AirLand Battle doctrine contains implications for field users and combat developers. The users will be forced to apply both automation and doctrine. They must recognize the orientation of the procedures embedded in the MCS and the ATCCS and those inherent in AirLand Battle doctrine. They must also understand how to exploit the existing capabilities of these tactical command and control automation systems to maximize their compatibility with the doctrine.

Combat developers must re-examine the command and control requirements of AirLand Battle doctrine. The management of information by tactical command and control automation systems must also be reviewed in terms of decentralized decisionmaking. The ATCCS must support the decentralized control required by AirLand Battle doctrine by providing the most critical elements of information to subordinates; minimizing the amount of information identified as critical to the decisionmaker; and increasing the commander's flexibility, in addition to continuing its emphasis on horizontal integration of battlefield functional area systems.

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